



ProTech InfoBrief: IB04

Polymer Coagulant/Flocculant Stormwater Treatment Performance

ProTech General Contracting Services has completed an initial series of tests to assess the effectiveness of various polymers applied in flow-through stormwater treatment systems. The tests included a series of jar tests to evaluate and compare polymer clarification efficiency - the effectiveness and efficiency of a polymer to clarify turbid stormwater.

Test Method

Four polymers were tested (two synthetic and two natural) that are currently in use by ProTech as well as other firms:

- Aluminum Chlorhydroxide ($Al_2Cl(OH)_5$)
- Diallyldimethyl Ammonium Chloride (DADMAC)
- Mimosa bark-based: derived from the bark of the Mimosa tree
- Chitosan (1% solution): derived from chitin, a component of shrimp and crab shells

Water for the tests was collected from a ProTech project site in the Sacramento, California area. The water, collected from a stormwater holding basin, contained high levels of colloidal material and iron oxides which was essentially impossible to remove by gravitational settling. Turbidity was measured at >1000 NTU. Although this water contained significant colloidal material and iron oxides, making it more difficult to treat than other stormwater, it is typical of many construction projects (particularly in the central/northern California region).

Polymer dosage was determined by a series of standardized jar tests conducted for each polymer. The first dose of each pair of data points for each polymer is considered here as the “optimum,” as it was based on the visual jar test results (i.e., the dose where the test water becomes visually clear) to determine the proper dosage. The dose of the second of each pair of data points is double the “optimum” dose, to represent a 2X overdose (i.e., overdosed by 100%). Note that Chitosan is supplied in a 1% Chitosan solution, so for example, 1000 ppm of the 1% solution is equal to 10 ppm pure Chitosan. The table below summarizes the jar test results.

Polymer Clarification Efficiency Summary				
Polymer	Dosage (ppm)	Turbidity (NTU)	Conductivity (mmhos)	pH
Control	0	>1000	59	7.15
$Al_2Cl(OH)_5$	75	38	74	7
	150	29	83	7
DADMAC	25	2	63	7.3
	50	5	61	7.3
Mimosa Bark	50	66	67	7.2
	100	41	76	7.2

Chitosan 1%	380	330	60	7.3
	600	78	81	7.0
	800	41	85	7.0
	1000	30	95	7.0
	1100*	53		
	2200*	25		

*The 1100 and 2200 ppm Chitosan doses were conducted on a different water sample from the same site, because the original sample was exhausted before the 2X test could be completed

Summary

The DADMAC polymer is clearly the most efficient, reducing turbidity from >1000 NTU to 2 NTU at a dose of 25 ppm. The aluminum chlorhydroxide and mimosa bark polymers yield approximately equal results, reducing turbidity to about 30-40 NTU at doses of 75-100 ppm. The 1% Chitosan solution required a dose of 1000 ppm to reduce turbidity to approximately 30 NTU.

Polymer coagulants/flocculants must be carefully selected to match a particular stormwater, because polymer reactions are dependent on the physical and chemical characteristics of the water. The results shown here are specific to the >1000 NTU stormwater used in these tests, although ProTech has found through project experience that this general trend is applicable in many cases. ProTech is continuing to evaluate polymer coagulants and flocculants with various and different stormwaters, and will be releasing those results in the future.